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DECAY OF FREE INDUCTION IN POLYVINYLCHLORIDE IN THE HIGH ELASTIC STATE*

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An experimental study was made of the form of decay of free induction (ID) in PVC samples with different molecular weights in the high elastic state. It was found that the form of ID differs from the form predicted by a model of rotary Brownian motion with a single correlation time. For the theoretical description of the form of ID an attempt was made to use the existing theory, which assumes anisotropic motion of the polymer chain.

It has been indicated [1] that the decay of free induction ID in a number of polymers, which are at temperatures higher than the glass temperature T_g, is not described by a simple exponential rule of the from

$$A(t) \sim \exp(-t/T_2), \quad (1)$$

where T_2 is the time of transverse nuclear relaxation, t, time of observation.

Analysis of results [1–8] suggests at least four causes responsible for the deviation of $A(t)$ from the exponential (1) when the nuclear spin system may be regarded as one consisting of separate spin pairs: 1) distribution of correlation times τ_c of molecular notion [2, 3], which may be the consequence of polydispersion of the polymer [4, 5], or its heterophase properties [6]; 2) non-exponential from of the correlation function of molecular motion e.g. due to density fluctuations [7], 3) existence of comparatively slowly fluctuating local magnetic fields formed by isotropic, but slow molecular motion [1]. Their existence is due to the considerable effect of molecular interactions on transverse relaxation; 4) existence of slowly fluctuating local magnetic fields due to the anisotropic motion of an isolated pair of nuclei [8].

If the first three causes of non-exponential nature $A(t)$ have been studied experimentally and theoretically, the latter hypothesis, so far, has not been studied seriously.

This study seeks to examine ID when $T > T_g$ for PVC and examine the accuracy of the latter assumption using this polymer. It should be noted that PVC is not an ideal model for the combination of separate nuclear pairs. However, as a consequence of the considerable importance of this polymer, we made an attempt to use this simplified idea for the description of the form ID.

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